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16.3

LLNL Authority Having Jurisdiction Requirements for Approving Electrical Equipment, Installations, and Work

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Recommended for approval by the ES&H Working Group

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* Minor revision

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LLNL Authority Having Jurisdiction Requirements for Approving Electrical Equipment, Installations, and Work

1.0 Introduction

1.1 Purpose and Scope

The National Electrical Code (NEC), NFPA-70, and 29 CFR 1910, Subpart S, specify that all electrical installations and equipment are acceptable for use *only* if approved by an Authority Having Jurisdiction (AHJ). Furthermore, the *Department of Energy (DOE) Model Electrical Safety Program* recommends that all DOE contractors establish an AHJ for electrical issues such as examining and approving electrical equipment that has not been tested by a nationally recognized testing laboratory (NRTL). In compliance with these requirements, the Lawrence Livermore National Laboratory (LLNL) has established an internal AHJ Program for ensuring electrical installations performed onsite and electrical equipment in use meet safety codes.

This document describes the Laboratory's AHJ Program and the responsibilities of those charged with its implementation. It also provides guidelines for designated AHJ personnel to ensure that electrical equipment in use is in compliance with Laboratory requirements, the NEC, and Occupational Safety and Health Administration (OSHA) regulations. A six-month period (following DOE's delegation of the authority) is established for implementation of this program. This should allow sufficient time to identify and train AHJ personnel, establish protocols, and begin AHJ operations. Operations may begin earlier if sufficient personnel are available.

In addition to the requirements in this document, Document 16.1, "Electrical Safety," and Document 16.2, "Work and Design Controls for Electrical Equipment," in the *ES&H Manual* contain requirements and guidance for specific types of electrical equipment and electrical work.

1.2 LLNL AHJ Structure

This section describes the AHJ organizational structure (Fig. 1), selection criteria, and the roles and responsibilities for the designated Program AHJ, Building AHJ, AHJ Field Representatives, AHJ Construction Electrical Inspector, and the Electrical Safety Advisory Board (ESAB). Additional responsibilities can be found in Section 4.0.

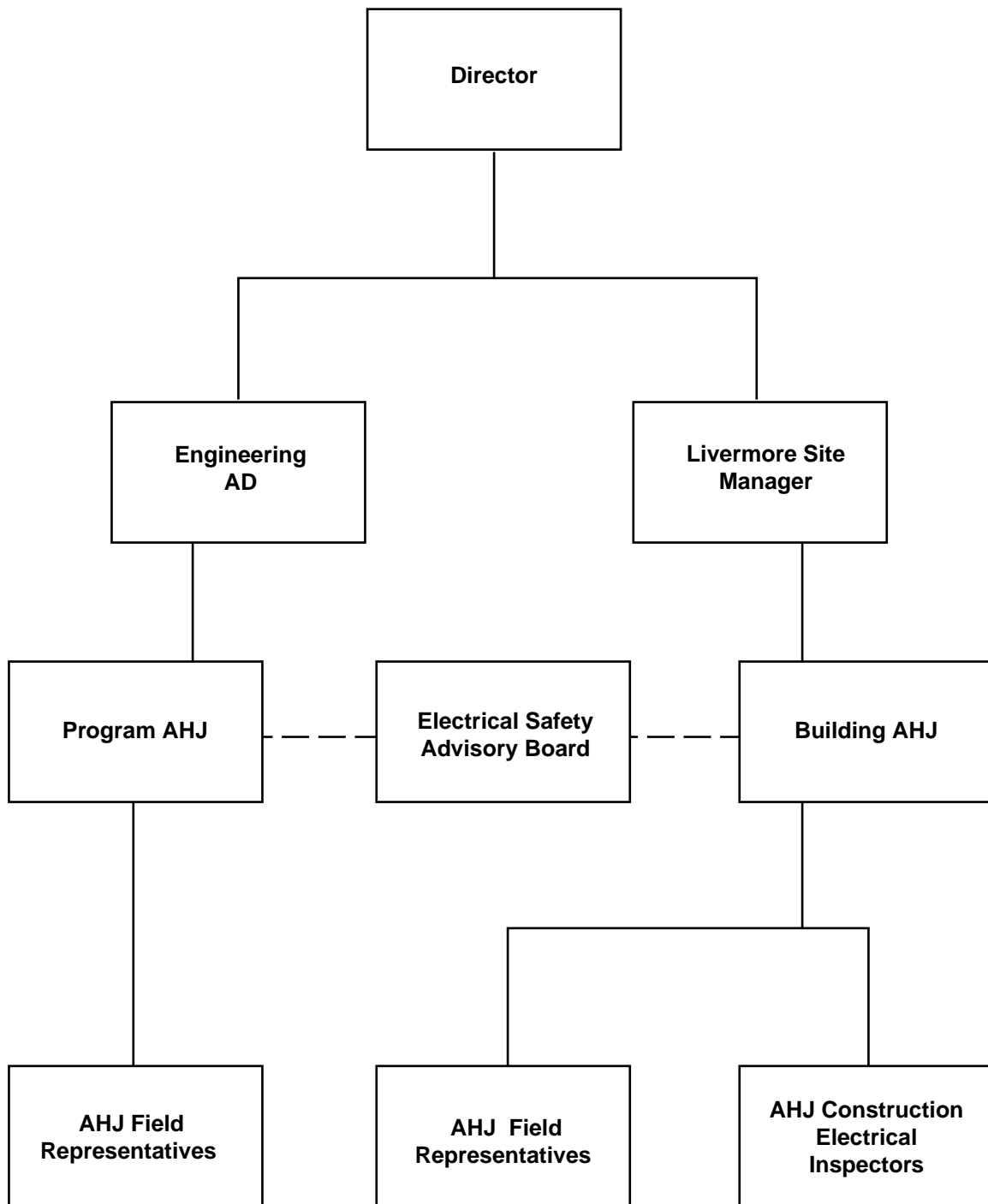


Figure 1. AHJ structure.

1.2.1 Program AHJ and Building AHJ

Two AHJs are assigned to address electrical issues at the Laboratory:

- A Program AHJ designated by the Associate Director (AD) for Engineering with jurisdiction over programmatic electrical equipment and installations (see Section 4.2).
- A Building AHJ designated by the Laboratory Site Manager (LSM) with jurisdiction over electrical work conducted on utility and facility electrical equipment and electrical installations (see Section 4.2).

AHJ field representatives, normally from the Engineering Directorate, shall support the Program AHJ. AHJ field representatives and AHJ construction electrical inspectors, normally from Plant Engineering, shall support the Building AHJ.

1.2.2 AHJ Field Representatives

The AHJ field representatives shall be persons within (or matrixed to) the directorate or organization and subject-matter experts in electrical codes, OSHA regulations, and other electrical requirements. They may be engineers, principal investigators, electricians, or senior technicians nominated by their organizations and approved by the Program AHJ or Building AHJ based on their knowledge of electrical codes and regulations, certification, training and education, and experience. Organizations that do not have a qualified person to serve as an AHJ field representative may have one assigned to them by the Program AHJ or Building AHJ.

1.2.3 AHJ Construction Electrical Inspectors

An AHJ construction electrical inspector shall be assigned to all Plant Engineering construction and renovation projects involving electrical work, and shall be available to assist with nonPlant Engineering construction and renovation projects when requested. This individual shall be certified by the International Conference of Building Officials/International Association of Electrical Inspectors (ICBO/IAEI) or have equivalent certification.

1.2.4 LLNL Electrical Safety Advisory Board

The LLNL Electrical Safety Advisory Board (ESAB) is commissioned by the Hazards Control Department to provide technical guidance and support to the Program AHJ, Building AHJ, AHJ field representatives, and AHJ construction electrical inspectors.

1.3 Training

The Program AHJ, Building AHJ, AHJ field representatives, and AHJ construction electrical inspectors shall have the training specified below. LLNL may develop additional training as needed.

- Basic and supplementary training in electrical work. Training requirements for electrical workers and electrical work performed at LLNL are described in detail in Document 16.1 and Document 12.6, "LLNL Lockout/Tagout Program," in the *ES&H Manual*.
- Training in the application of OSHA regulations (e.g., 29 CFR 1910, Subpart S; 29 CFR 1910.269; and 29 CFR 1926, Subpart K) applicable to electrical work.
- Training in application of the NEC.
- Site-specific electrical training provided by nationally recognized electrical training specialists.

In addition to the above training, AHJ construction electrical inspectors shall be certified by the ICBO/IAEI or have equivalent certification. Other AHJ personnel are encouraged to obtain ICBO/IAEI (or equivalent) certification.

2.0 Hazards

Electricity is used in many different ways at LLNL. Each application has its own combination of hazards that includes the potential of electric shock, fire, and burns. Thus, it is essential for the proper use of electrical conductors and electrical equipment to have an AHJ onsite to address all electrical issues.

3.0 Examining and Approving Electrical Equipment, Installations, and Work

It is a Laboratory requirement (based on the NEC) that all electrical equipment and components, including research and development (R&D) equipment, shall be NRTL labeled or listed, or examined and approved by AHJ personnel prior to use. R&D equipment often is not NRTL approved because of its unique nature. However, it is important to note that work on R&D electrical systems (e.g., electronic circuits) is considered electrical work and therefore shall conform to the safety requirements in the NEC and 29 CFR 1910, Subpart S.

The Laboratory further requires that all newly acquired electrical equipment, obtained on or after the end of the implementation period (anticipated to be August 1, 2000), to which the Work Smart Standards apply, shall either be NRTL labeled or listed, or

examined and approved by AHJ personnel prior to use. Similarly, all existing electrical equipment in storage or that has not been in use as of August 1, 2000, and not listed or labeled by an NRTL also shall be examined and approved by AHJ personnel before being placed into service. All electrical equipment that has been modified shall be examined and approved by AHJ personnel before being placed into service. Existing, in-service safety-class and safety-significant electrical equipment shall be identified, prioritized, and examined by AHJ personnel by December 31, 2000. Other existing in-service electrical equipment shall be subject to AHJ examination on a prioritized basis.

It is recognized that establishing an AHJ to address electrical issues related to approval of electrical equipment, installations, and work is an extensive undertaking because there is a significant amount of nonNRTL-approved electrical equipment and installations currently in use at LLNL.

3.1 Acceptance Criteria

Electrical codes and regulations specify that all electrical equipment shall be used in accordance with listing and labeling requirements. Thus, AHJ personnel shall review and approve electrical equipment, installations, and work at LLNL based on at least one of the following criteria before being placed into service:

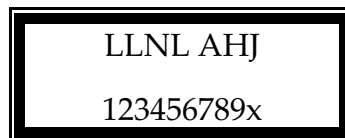
1. If the electrical equipment is listed or labeled by an NRTL, no examinations or other actions are required.
2. Electrical equipment (including custom-made Laboratory electrical equipment) that is not NRTL listed or labeled will be acceptable if examined by AHJ personnel in accordance with the provisions of the NEC. The equipment shall either meet the code requirements or it shall be demonstrated that equivalent safety can be achieved. If the electrical equipment is not acceptable but can be modified, AHJ personnel may recommend the necessary modifications.
3. Foreign-manufactured electrical equipment, unless listed or labeled by an NRTL, shall be examined by AHJ personnel to ensure that its construction and wiring comply with requirements in the NEC and 29 CFR 1910, Subpart S. See item 2 above.
4. All modifications to NRTL-listed electrical equipment shall be examined by AHJ personnel.
5. All electrical equipment installations and work shall be examined by AHJ personnel.

For items 2–5, AHJ personnel shall prepare and maintain an AHJ Field Report for review by the equipment supervisor.

Note: Electrical equipment that has been subjected to a formal design review and building electrical systems that have been signed off by a Registered Professional Engineer shall be considered to have met the NEC design criteria. However, AHJ personnel shall examine such electrical equipment and systems to ensure they were constructed and installed according to the design and code requirements (or their equivalents).

3.2 Labeling Electrical Equipment

A label similar to that illustrated below shall be affixed to all electrical equipment approved by AHJ personnel (see items 2–4 in Section 3.1). The label number will be included in the AHJ Field Report for identification.



The Program AHJ and Building AHJ shall establish protocols for labeling very small equipment and components and LLNL-designed electrical equipment produced in quantities greater than one.

3.3 Preparing AHJ Field Report

A written AHJ Field Report is required for all electrical equipment examined (e.g., non-NRTL labeled or listed electrical equipment approved for use at LLNL), installations, and work. The report shall be prepared by AHJ personnel and contain the following information if the electrical equipment is acceptable:

- A description of the electrical equipment and the property number, if applicable.
- A list of safety codes, standards, or checklists used to determine if the electrical equipment is acceptable.
- An assessment of the area where the electrical equipment will be used, if significant, and any required controls for ensuring personnel safety and equipment protection.

If the electrical equipment is not acceptable, the report shall contain the following information:

- A description of the electrical equipment and the property number, if applicable.

- A list of safety codes, standards, or checklists used to determine why the electrical equipment is not acceptable and the reasons for noncompliance.
- An assessment of the area where the electrical equipment would have been used and the reasons why personnel safety and electrical equipment protection cannot be assured.
- Any recommended corrective action (redesign or procure appropriate equipment) to ensure personnel safety and equipment protection.

Copies of the AHJ Field Report shall be provided to the equipment supervisor, ESAB, and appropriate AHJ. The ESAB shall maintain a record of all AHJ Field Reports.

3.4 Personal Appliances

All personal appliances used in the workplace (e.g., coffeepots, refrigerators, and radios) shall be NRTL listed or labeled.

4.0 Responsibilities

All workers and organizations with responsibility for the Laboratory's AHJ Program shall refer to Document 2.1, "Laboratory and ES&H Policies, General Worker Responsibilities, and Integrated Safety Management," in the *ES&H Manual* for a list of general responsibilities. Specific responsibilities are listed in the subsections following.

4.1 Management

- Ensure the following:
 - Electrical installations and work performed at the Laboratory are examined in accordance with the requirements in this document.
 - Nonlisted or labeled electrical equipment fabricated, manufactured, or installed after August 1, 2000, is examined in accordance with the requirements in this document. NonNRTL-approved electrical equipment in storage or not in use shall be examined before activation. Safety issues identified during this review must be addressed.
 - Any potential imminently dangerous situation is corrected immediately.
 - Adequate resources are available to mitigate electrically hazardous conditions and to ensure compliance with applicable codes and standards. Consideration should be given to the priorities of other hazardous conditions that might also have to be addressed.
 - Deficiencies found during AHJ examinations are corrected before the electrical equipment is placed into operation.

- Drawings of all electrical systems and equipment, including utility, facility, and programmatic systems; equipment single-line diagrams; panel board; switchboard; control; ladder networks; schematic; layout; and interconnection diagrams are current.

4.2 Program and Building AHJs

- Make interpretations of the NEC rules and other electrical requirements, approve electrical equipment and materials for use, and grant special permission contemplated in a number of the rules. The AHJ may waive specific requirements in the NEC or permit alternate methods and work practices where it can be assured that equivalent safety objectives have been met.
- Delegate to AHJ field representatives and AHJ construction electrical inspectors the authority to interpret NEC rules and other electrical requirements and to examine and approve electrical equipment. Determinations made by AHJ personnel will stand unless overturned by the appropriate AHJ.
- Develop protocol for AHJ personnel to
 - Interpret NEC rules and other electrical requirements.
 - Approve electrical equipment, wiring methods, electrical installations, and materials for use.
 - Permit alternate methods if equivalent safety protection can be provided.
 - Ensure electrical equipment is in compliance with electrical codes and standards.
- Review and validate AHJ Field Reports.
- Review and validate all NEC and OSHA interpretations, approvals, and permitted alternate methods made by AHJ personnel.
- Maintain all documentation of AHJ activities (e.g., interpretations of NEC and OSHA rules, approvals of electrical equipment and materials, permitted alternate methods) and AHJ Field Reports. (The ESAB shall maintain these records for the AHJs.)
- Establish limits of authority for AHJ field representatives and AHJ construction electrical inspectors.
- Assess overall program effectiveness on a periodic basis and make improvements as appropriate.

4.3 AHJ Field Representatives

- Interpret OSHA regulations, NEC rules, and other standards listed in Section 5.0 that are applicable to electrical equipment in use at LLNL.
- Examine (or inspect) and approve (or disapprove) for use electrical equipment (e.g., electronic panel boards, switchboards, shop-built extension cords, power supplies, R&D equipment) and installations or recommend modifications to nonapproved electrical equipment that, if implemented, will result in approval.
- Permit alternate methods from the NEC, if it can be assured that equivalent safety objectives are met. Verify all modifications meet or exceed established codes and standards.
- Participate in design reviews as requested.
- Label approved electrical equipment.
- Prepare AHJ Field Reports.
- Perform AHJ functions (e.g., inspections) in other directorates and organizations upon request.
- Coordinate with explosives safety personnel the work in explosives area.

4.4 AHJ Construction Electrical Inspectors

AHJ construction electrical inspectors have the same responsibilities as AHJ field representatives (see Section 4.3) and shall perform these tasks in accordance with protocols established by the Building AHJ. These individuals also are responsible for inspecting electrical work for construction and renovation projects.

4.5 Electrical Safety Advisory Board

The Electrical Safety Advisory Board (ESAB) is an electrical safety resource to the Program AHJ, Building AHJs, AHJ field representatives, and AHJ construction electrical inspectors. The ESAB shall maintain a record of all AHJ Field Reports for the AHJ personnel.

5.0 Work Standards

NFPA 70, "National Electrical Code."

ANSI C2, "National Electrical Safety Code." (This code is referenced in the Appendix to Subpart S of 29 CFR 1910.)

29 CFR 1910, Subpart S, "Electrical."

29 CFR 1910.269, "Electric power generation, transmission, and distribution" (latest version).

29 CFR 1926, Subpart K, "Electrical."

6.0 Resources for More Information

6.1 Contacts

For additional information regarding this document, contact the following:

- Safety Programs Division of the Hazards Control Department.
- Electrical Safety Advisory Board.

6.2 Lessons Learned

For lessons learned applicable to this document, refer to the following Internet address:

http://www-r.llnl.gov/es_and_h/lessons/lessons.shtml

6.3 Other Sources

DOE Model Electrical Safety Program, Sandia National Laboratories, Livermore, CA (May 1993).

Electrical Safety Handbook, U.S. Department of Energy, Washington, DC, DOE-HDBK-1092-98, (January 1998).

Appendix A

Terms and Definitions

Authority Having Jurisdiction (AHJ) (electrical)	A person who interprets the requirements of electrical codes and standards, approves electrical equipment for use, and coordinates the activities of staff.
AHJ field report	<ol style="list-style-type: none"> 1. A written report verifying that a piece of electrical equipment or an installation is acceptable for use. <p style="text-align: center;">OR</p> <ol style="list-style-type: none"> 2. A written report describing the reasons why electrical equipment does not comply with a mandatory standard. It may include recommendations to achieve equivalent safety criteria.
AHJ personnel	Program AHJ, Building AHJ, AHJ field representatives, and AHJ construction electrical inspectors.
Electrical equipment	Equipment that uses electrical energy for electronic, electromechanical, or chemical operations; heating; lighting; or similar purposes. Electrical equipment includes equipment used in laboratory research and development (R&D) as well as utility, facility, and shop equipment.
Examination	A process performed by a person qualified to evaluate whether or not electrical equipment is free from recognized hazards and meets code requirements.
Labeled	A nationally recognized testing laboratory (NRTL) label, symbol, or other identifying mark that is affixed to equipment or materials.
Listed	Electrical equipment and materials listed by an organization concerned with product evaluation that have been examined against designated standards and found to be suitable for use in specified operations. The means of identifying electrical equipment may vary among listing organizations, some of which do not recognize equipment as listed unless it is also labeled. Therefore, AHJ should utilize the system employed by the listing organization to identify a listed product.

Nationally recognized
testing laboratory
(NRTL)

An organization that is recognized by OSHA as an acceptable laboratory for product evaluation and maintains records of periodic examinations of equipment and materials. The NRTL ensures that equipment and materials comply with designated standards or are tested to determine their suitability for use.